Table 5-2. Dose-Response Variables and Recommended Screening Values (SVs) for Target Analytes

Target analyte	Noncarcinogens RfD[b] (mg/kg/d)	Carcinogens SF[b] $(mg/kg/d)^{-1}$	SV[a] (ppm) Noncarcinogens	SV[a] (ppm) Carcinogens (RL=10^{-5})
Metals				
Arsenic (inorganic)[c]	3×10^{-4} [d]	NA[e]	**3**	—
Cadmium	1×10^{-3}	NA	**10**	—
Mercury[f]				
Developmental	6×10^{-5} [g]	NA	**0.6[d]**	—
Chronic systemic	3×10^{-4} [h]	NA	3[h]	—
Selenium[i]	5×10^{-3}	NA	**50**	—
Tributyltin	3×10^{-5} [d]	NA	**0.3**	—
Organochlorine Pesticides				
Total chlordane (sum of cis- and trans-chlordane, cis- and trans-nonachlor, and oxychlordane)[j]	6×10^{-5}	1.3	0.6	**0.08**
Total DDT (sum of 4,4'- and 2,4'-isomers of DDT, DDE, and DDD)[k]	5×10^{-4}	0.34	5	**0.3**
Dicofol	1×10^{-3} [l]	NA	**10**	—
Dieldrin	5×10^{-5}	16	0.6	**7×10^{-3}**
Endosulfan (I and II)	6×10^{-3} [m]	NA	**60**	—
Endrin	3×10^{-4}	NA	**3**	—
Heptachlor epoxide	1.3×10^{-5}	9.1	0.1	**0.01**

See notes at end of table

(continued)

Table 5-2 (continued)

Target analyte	Noncarcinogens	Carcinogens	SV[a] (ppm)	
	RfD[b] (mg/kg/d)	SF[b] $(mg/kg/d)^{-1}$	Noncarcinogens	Carcinogens (RL=10^{-5})
Metals				
Hexachlorobenzene	8×10^{-4}	1.6	9	**0.07**
Lindane (γ-hexachlorocyclohexane; γ-HCH)	3×10^{-4}	1.3[n]	3	**0.08**
Mirex	2×10^{-4}	NA[o]	**2**	—
Toxaphene	2.5×10^{-4} [l,p]	1.1	3	**0.1**
Organophosphate Pesticides				
Chlorpyrifos	3×10^{-3}	NA	**30**	—
Diazinon	9×10^{-5} [l]	NA	**0.9**	—
Disulfoton	4×10^{-5}	NA	**0.5**	—
Ethion	5×10^{-4}	NA	**5**	—
Terbufos	1.3×10^{-4} [l]	NA	**1**	—
Chlorophenoxy Herbicides				
Oxyfluorfen	3×10^{-3}	1.3×10^{-1}	30	**0.8**
PAHs	NA	7.3[d,q]	—	**0.01**
PCBs				
Total PCBs (sum of Aroclors)	2×10^{-5} [d,r]	7.7[s]	0.2	**0.01**
Dioxins/furans[t]	NA	1.56×10^{5}	—	**7×10^{-7}**

(continued)

Table 5-2 (continued)

NA = Not available in EPA's Integrated Risk Information System (IRIS, 1992).
PAH = Polycyclic aromatic hydrocarbon.
PCB = Polychlorinated biphenyl.
RfD = Oral reference dose (mg/kg/d).
RL = Risk level (dimensionless).
SF = Oral slope factor $(mg/kg/d)^{-1}$.

[a] Except for mercury, screening values (SVs) are target analyte concentrations in fish tissue that equal exposure levels at either the RfD for noncarcinogens or the SF and an $RL=10^{-5}$ for carcinogens, given average consumption rates (CRs) and body weights (BWs) of 6.5 g/d and 70 kg, respectively, for the general adult population (U.S. EPA, 1989d). **Note:** These values have been determined by rounding the final calculated value to one significant figure. EPA believes that using more than one significant figure would imply a degree of precision that is not warranted given the large uncertainty factors generally used in deriving SVs. For target analytes with both carcinogenic and noncarcinogenic effects, the lower (more conservative) of the calculated SVs should be used. **Note:** Values in the shaded boxes are SVs recommended for use in State fish/shellfish consumption advisory programs for the general adult population. States may choose to use other SVs based on different CRs, BWs, and/or an RL ranging from 10^{-4} to 10^{-7}.

[b] Unless otherwise noted, values listed are the most current oral RfDs and SFs in EPA's IRIS (IRIS, 1992).

[c] Total inorganic arsenic should be determined for comparison with the recommended SV.

[d] From IRIS (1995).

[e] The SF for inorganic arsenic is currently under review by the Agency. At this time, EPA does not have a cancer SF for inorganic arsenic to recommend for use in conducting fish consumption risk assessments.

[f] Because most mercury in fish and shellfish tissue is present as methylmercury (NAS, 1991; Tollefson, 1989) and because of the relatively high cost of analyzing for methylmercury, it is recommended that total mercury be analyzed and the conservative assumption be made that all mercury is present as methylmercury. This approach is deemed to be most protective of human health and most cost-effective.

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[g] **Note:** The EPA has recently reevaluated the RfD for methylmercury, primarily because of concern about evidence that the fetus is at increased risk of adverse neurological effects from exposure to methylmercury (Marsh et al., 1987; Piotrowski and Inskip, 1981; NAS, 1991; WHO, 1976, 1990). On May 1, 1995, IRIS was updated to include an oral RfD of $1x10^{-4}$ mg/kg/d based on developmental neurological effects in human infants. An oral RfD of $3x10^{-4}$ mg/kg/d for chronic systemic effects of methylmercury among the general adult population was available in IRIS until May 1, 1995; however, it was not listed in the IRIS update on that date. For the purposes of calculating an SV for methylmercury that is protective of fetuses and nursing infants, the EPA Office of Water has chosen to continue to use the general adult population RfD of $3x10^{-4}$ mg/kg/d for chronic systemic effects of methylmercury until a value is relisted in IRIS, and to reduce this value by a factor of 5 to derive an RfD of $6x10^{-5}$ mg/kg/d for developmental effects among infants. This factor is based on experimental results that suggest a possible fivefold increase in fetal sensitivity to methylmercury exposure. This more protective approach recommended by the EPA Office of Water was deemed to be most prudent at this time. This approach should be considered interim until such time as the Agency has reviewed new studies on the chronic and developmental effects of methylmercury.

[h] This RfD is used in risk assessment calculations for the general adult population (see Volume II of this guidance document series [U.S. EPA, 1994]). It is not recommended that this SV be used in screening programs because it may not be protective of women of reproductive age and children.

[i] The RfD for selenium is the IRIS (1992) value for selenious acid. The evidence of carcinogenicity for various selenium compounds in animal and mutagenicity studies is conflicting and difficult to interpret. However, evidence for selenium sulfide is sufficient for a B2 classification (IRIS, 1992).

[j] The RfD and SF values listed are derived from studies using technical-grade chlordane (purity ~95%) or a 90:10 mixture of chlordane:heptachlor or analytical-grade chlordane (IRIS, 1992). No RfD or SF values are given in IRIS (1992) for the cis- and trans-chlordane isomers or the major chlordane metabolite, oxychlordane, or for the chlordane impurities cis- and trans-nonachlor. It is recommended that the total concentration of cis- and trans-chlordane, cis- and trans-nonachlor, and oxychlordane be determined for comparison with the recommended SV.

[k] The RfD value listed is for DDT. The SF value is for DDT or DDE; the SF value for DDD is 0.24. The U.S. EPA Carcinogenicity Assessment Group recommended the use of SF = 0.34 for any combination of DDT, DDE, DDD, and dicofol (Holder, 1986). It is recommended that the total concentration of the 2,4′- and 4,4′-isomers of DDT and its metabolites, DDE and DDD, be determined for comparison with the recommended SV.

[l] The RfD value listed is from the Office of Pesticide Program's Reference Dose Tracking Report (U.S. EPA, 1993b).

[m] The RfD value listed is from the Office of Pesticide Program's Reference Dose Tracking Report (U.S. EPA, 1995j).

(continued)

Table 5-2 (continued)

[n] IRIS (1992) has not provided an SF for lindane. The SF value listed for lindane was calculated from the water quality criteria (0.063 µg/L) (U.S. EPA, 1992e).

[o] The National Study of Chemical Residues in Fish (U.S. EPA, 1992c, 1992d) used a value of SF = 1.8 for mirex from HEAST (1989).

[p] The RfD value is the Office of Pesticide Programs value; this value was never submitted for verification.

[q] The SF value listed is for benzo[*a*]pyrene. Values for other PAHs are not currently available in IRIS (1995). It is recommended that, in both screening and intensive studies, tissue samples be analyzed for benzo[*a*]pyrene, benz[*a*]anthracene, benzo[*b*]fluoranthene, benzo[*k*]fluoranthene, chrysene, dibenz[*a,h*]anthracene, and indeno*[1,2,3-cd*]pyrene, and that the order-of-magnitude relative potencies given for these PAHs in the EPA provisional guidance for quantitative risk assessment of PAHs (U.S. EPA, 1993c) be used to calculate a potency equivalency concentration (PEC) for each sample for comparison with the recommended SV for benzo[*a*]pyrene (see Section 5.3.2.3). At this time, EPA's recommendation for risk assessment of PAHs (U.S. EPA 1993c) is considered provisional because quantitative risk assessment data are not available for all PAHs. This approach is under Agency review and over the next year will be evaluated as new health effects benchmark values are developed. Therefore, the method provided in this guidance document is subject to change pending results of the Agency's reevaluation.

[r] The RfD for PCBs is based on the chronic toxicity of Aroclor 1254 (IRIS, 1995). This RfD is lower than the RfD that is available in IRIS (1995) for the developmental toxicity of Aroclor 1016 ($7x10^{-5}$) and, therefore, is protective against both chronic systemic toxicity and developmental toxicity. See Volume II (Section 5.6.19) of this guidance document series (U.S. EPA, 1994b) for a more detailed discussion of toxicity data for PCBs and their use in conducting quantitative risk assessments and determination of consumption limits.

[s] The SF is based on a carcinogenicity assessment of Aroclor 1260. The SF of Aroclor 1260 is intended to represent the upper bound risk for all PCB mixtures (IRIS, 1992).

[t] The SF value listed is for 2,3,7,8-tetrachlorodibenzo-p-dioxin (TCDD) (U.S. EPA, 1986c). The National Study of Chemical Residues in Fish used a value of RfD = $1x10^{-9}$ for 2,3,7,8-TCDD from ATSDR (1987d). It is recommended that, in both screening and intensive studies, the 17 2,3,7,8-substituted tetra- through octa-chlorinated dibenzo-p-dioxins and dibenzofurans be determined and a toxicity-weighted total concentration be calculated for each sample for comparison with the recommended SV, using the revised interim method for estimating Toxicity Equivalency Concentrations (TECs) (Barnes and Bellin, 1989; U.S. EPA, 1991h). If resources are limited, the 2,3,7,8-TCDD and 2,3,7,8-TCDF congeners should be determined at a minimum.